is IS 136. Trying to solve for this problem and believe other technologies. Remember that in IS136 1 bit is approximately equal to 1 frame (so there are 8 opportunities to wipe out a letter). Ericsson showed acceptable error rate for GSM and IS136. Channel coding - once phone is connected to TTY all features run through the phone. Would like to work with more phone manufacturers. Testing has been a problem because there are no digital voice channels to run testing in Central California. Do not have a 2.5 mm jack as yet, has RJ11, RJ45, and headphone jack for VCO/HCO. Ultratec is largest provider and has a widely varied quality of receivers. Some are performing beyond the requirements of digital and some are not. They are designed for landline performance. Disagree with the change of tone as a solution. Believe solution is in the improvement of the transmission itself. Testing is done in a lab, in a closed loop environment, Base station designed by Lober, at high tolerance. All static testing, some drive testing, forward traffic messaging (hand-offs etc) seems to be OK. Ericsson has seen loss of one character during a handoff in their testing. Tests used are alphanumeric but Lober is open to any testing method. Currently compatible phones are all Motorola flip phones. Customers can buy product directly from Lober under Lober & Walsh Engineering, Cellular Product Technologies, Inc. Web-site is) www.cellulartty.com Goal of Lober and Walsh is to join next meeting (July) with a demonstration of TTY over digital.

- ERICSSON presentation
  Presenting quickest way to solve for present TTYs and will be acoustic handset coupling for short-term. This approach has been successfully tested for users and will be completed before Oct. 1 and available for all Ericsson handsets. The medium term solution will be a direct electrical connection. Presented at TR45, with direct acoustic coupling, the standardized solution would offer opportunity for all phones to be compatible through standards process. Long-term solution would be a direct coupling to the TTY. Understanding the most appropriate process through the TTY Forum will help with solution. Ericsson will work with operators and will work through Gallaudet and assist AT&T Wireless for a solution. Error rate is 1% with GSM and 6% with IS 136 for short-term solution. Transmission through TTY and wireless network will eventually run digital but will have to convert back to analog for POTS transmission. There is a standardized connector for DCE-DTE approved a year ago in TIA TR30.2 (see contact Dick Brandt for information). Ericsson is taking consumer comments into consideration. Voice-through will be part of intermediary solution and should be standardized by a standards body.

- Sendele Wireless Solutions Inc.
  Company presentation made by Steve Sendele on AxCell interface device - Steve Sendele discussed Axcel wireless interface. Topic of conversation is how the TTY device connects to the phones. List of compatible phones is

available. Mission of the company is to become dominant supplier... All phones are analog except DT2000 (digital)
Why does air interface technology matter to the data interface? The interface device only reads the handset.
Answer: the buss structure changes.

- Analog Phone / TTY Devices List
    CTIA is in process of gathering a manufacturer list and has run into a problem with proprietary disclosure with some manufacturers. Questionnaire asked specific questions but will be changed to ask a simple compatibility question to complete list as quickly as possible.

12. WORKING GROUP REPORTS

- **WORKING GROUP #1/3**
    Wesley Howe, chair
    Ahmed Tarraf, CDMA testing – system test had limitations which will be discussed.
    Conclusion of test results is that CDMA can be transmitted through the vocoder successfully.
    TTY modems produce a signal level 7db higher
    Frame error rate is dominant factor in the Character Error Rate (i.e. 1% Frame Error Rate is almost 9% Character Error Rate)
    Normal operation would translate to 8-16% Character Error Rate depending on the carrier. In the lab the vocoder can pass the signal at 0% error rate. The vocoder is not the problem. There is error correction for data but not for voice. The difference between connector S (i.e. direct electrical connection vs. a handset acoustical) is a factor that introduces error – the direct electrical connection introduces minimal error. For initial testing, coupling will be a minimal issue if it does not introduce error. For the end product, the coupler will be important. Stop bits range from 1.0-2.0 the ration error might change depending on the stop bit. Modem produced 2.0 stop bit error consistently. Short term solution is to maintain FER as close to 0% SO TRANSMIT more power on the reverse link to achieve 0% FER. Must keep vocoder at full rate at all times. Phone should be at full rate at all times during TTY transmission. Short-term solution is to create a small firmware change in the power control in the model. Then send bad frame bits to trick system into sending at full power.

    NOKIA, Muhammed El-Rayes
    Possible causes for error:
    - Coupling
    - DSP Baseband functions
    - Vocoder Parameters
    - Link Conditions

- Network Factors

AMPS Measurements show error rate less than 1%.

PCS 1900 shows error rate about 2-4%.

TDMA shows error rate of greater than 10%

CDMA show error rate of less than 10%

CDMA can work in time for Oct 1 but if the EVRC proliferates throughout the networks then CDMA will be unacceptable. The solution is to ask service providers to fix the rate at 13Kbps   Comments indicate that the EVRC issue is fixed.

Conclusions: The vocoder rate is likely the major effect on error rate. A direct connection is more robust. Possible future solutions:

- ITU-T V.18
- TR45.3 (TDMA): US1 Vocoder (12.4 Kbps)
- Completely bypass vocoder
- Fix the rate for CDMA networks
- TR45.5 FAX standard for CDMA WLLs

SPRINT PCS, Ted Holdahl

Contribution of live test results. Supports findings of other CDMA tests. If vocoder is not an issue then power is an issue. Sprint is set up for 1% frame errors. Turbo code entry made be in error since turbo code does not send numbers as indicated on test result. Close loop power control will tell the handset to reduce power until it detects an error. Base to handset is an open loop power set. Base is slower to respond than closed link but it still attempts to increase power to improve transmission to set level of error rate.

MOTOROLA, Paul Mollar

Systems tested: NAMPS – 800 Mhx
    NADC- 800Mhz
CDMA - 800Mhz
TDMA
GSM

Postulated that error rate is based on type of echo cancellor. As error rate goes up the possibility of a shift error goes up also. Consequence of a shift error is that an entire sentence is lost when a shift error occurs.

- Through Put Testing

- Update Matrix

Based on contributions, Chair of Working Group #1/3 will enter test data into Matrix to provide a summary to be included in TTY-5.

- Review Draft SRD - 2.5mm jack

Ericsson submitted draft with information and findings to formulate an actual SRD. The long-range plan could be to submit for standardization

but the process could be 18 months to complete the standards process. Recommendation that the document be established as an agreed to technical document from the TTY Forum to give guidelines to manufacturers. Recommend that this document be reworked by Lee Whritenour and working group then resubmitted as a TTY Forum Technical Information Document. Document will be for information purposes only and is not intended as an exclusive solution or requirement. Group will consist of Lee Whritenour, Paul Mollar, Steve Sendele, and Ron Schultz.

- ## REPORT OF WORKING GROUP #2

Brye Bonner, Motorola, chair,

Air interfaces, inner working function cannot be separated out. For future modems will not be part of the solution. It will require changes to the MSC. This is a data only solution and will not incorporate Baudot. Could be made to support Baudot with V.18. This is for future solution but does not exclude POTS. This will connect from wireless digital through the network then back to the wireline (POTS) at the PSAP. This is not just for 9-1-1. There will be a communications process that could carry data and allow interconnection for data for normal traffic and emergency traffic. This is the same solution that is being proposed for Europe by European Telecommunications Standards Institute (ETSI). This committee could assemble a set of requirements and submit to a standards body. This would allow manufacturers to produce equipment that would have a common interface. The standards are voluntary. Request from the chair that the TTY Forum provide comments in the form of written contributions at the next TTY Forum.

- Presentation – DSPG Ltd., George Kokoski

    Involved in satellite telephony, speech compressor for vocoders. They work in a very noisy environment. The old technology does not take advantage of new advances. In Europe there is a large problem with text telephone because of lack of standards. V.18 is an attempt to standardize the system and allow TTYs to communicate. Extensive testing of Ultratec and many European models. First issue is connectivity – transmit data over various vocoders (except CDMA but that might work as well in voice band data). Connect the mobile phone to the text teletype machine. Using direct coupling, inexpensive interface (5$) and cable ($2) – PCMPCIA card. Solution uses adaptive gain controls, which automatically adjusts network gain. Adaptive control is not part of V.18, which is a protocol. V.18 allows the devices to detect what protocol is being used. Most text telephones are two wire which is a disadvantage because they must be adapted to a four wire and there is a problem

of echo. There is no volume control required because it is set adaptively. GSM doesn't carry Baudot very well (but does work well with a European alternative protocol). Implementing on two or three different platforms. Products will be available by he end of the year. Concept of new text telephone will be available by the end of the summer. Includes an open port, which will allow additional flexibility in future. Text Telephone digital available for ISDN with available features. Stand-alone system is available currently. V.18 is ideally suited to Relay calls

- Tegic Communications, Cliff Kushler
  T-9 handset is one finger typing on telephone handset. Software determines the likely word, if software is wrong then additional keystrokes will allow typist to scroll through other possibilities. To type numbers press and hold for set time and it will revert from letter to number. With 16 hours of practice, typist could type at 75 words per minute. This technology is just to make the keypad type words. Technology requires 50k and could be integrated into whatever send mode is required.
- Review Draft SRD – V.18

Davis Baquis, SHHH
Voice through is recommended as a replacement to VCO/HCO to avoid confusion with the Relay Services. Include this in the document for consumer features document to allow consideration of the needs of people who want to use their own voice in an emergency call. Beta tests at some PSAPs to try the ability to toggle between voice and TTY. 26-28 million people in the country have hearing loss. Some may buy mobile phones but not be users of TTY. FCC would like estimates of how many people are using voice through. Will poll at the next convention. What is the definition of VCO/HCO? Relay Services: VCO – consumer has text telephone and receiving end doesn't. This requires a third party to translate conversation and pass it through. HCO – a person who can't speak but can hear and requires an intermediary to translate typed information. It is not simultaneous – one or the other transmits. Current trends could make each handset a text telephone as well. In voice over will there be anything to specify whether the user will be speaking or will be hearing because the device should not be configured to both simultaneously because it will clutter transmission. Comment: There is concern at the FCC and in the industry that the PSAPs are not prepared to receive these voice-through style calls.

Recommendations from group:
Add to goals of interface group to specify connection.
At the next TTY Forum David Baquis will provide the TTY Forum- 6 a

written contribution clarification for the group. Also needed is a contribution regarding PSAP's ability to receive calls via voice-through. Have a separate luncheon speaker to clarify issue. And invite Department of Justice to next meeting to discuss access issues. Claude Stout will provide speaker from DOJ

13. DISCUSS AND DEFINE *END USER TEST*

Toni Dunn, Texas 9-1-1, chair. Presentation by Judy Harkins, Gallaudet University
This is not the best process to arrive at valid results. There should not be a subjective. Manufacturers need to have a benchmark to target. To identify where communication breaks down may not describe the acceptable error rate for consumers in an emergency. The error rate for analog is about 1% or less and that may be the error rate that is acceptable for digital. A working group should be formed and should include consumers, manufacturers, and emergency services. Conditions must be specified because signal strength has to be at a certain level.
Comments:
Even hearing users experience dropped calls and static in the wireless calls.
It is possible to create a box to add conditions to the line. That way the testing can be very precise.
Should the name of the test be changed to End User Validation or Benchmark?
The test should be administered as a benchmark and then as a validation. It should be administered in a controlled environment.
Recommendation from the chair: Create a study group to be accountable for the completion of the benchmarking and validation of TTY over digital.
Study Group:
Judy Harkins, leader
John Melcher
David Baquis
Josh Lober
Ron Schultz
Norman Williams
Deliverable for next TTY Forum: Benchmark and Validation Test

14. IDENTIFY POSSIBLE WORK EFFORT REGARDING INTERFERNECE BETWEEN PHONES AND TTY DEVICES

Remand this question to Working Group #1/3 and wait for a contribution offering evidence of the nature of the problem.

15. REVIEW CONSUMER REQUIREMENTS DOCUMENT

All written comments should be forwarded through the list server to Judy Harkins and Lynsie Hall to be shared with everyone. Deadline for comments is June 4, 1998.
Oral comments from:
Nokia – Two documents reflecting near-term and long-term goals

GTE – Some of these features represent burdens of cost or liability. Starting with 3.0 Availability – this could represent a burden to supply and stock. 4.0 Features – it's clear that the consumers don't want to be stuck with low cost, de-featured phones. Ericsson indicated that their solution would fit all their phones. This would fit the criteria. Vibrators are available on several models of most manufacturers' phones. Visual indication that call has been disconnected is available on varied models but could be significant to some manufacturers. 5.0 Consumer Information – May not be achievable by October 1 because of nature of planning for national campaigns, but should be achievable.

16. SEC 255 NPRM

Summary by Karen Pelz-Strauss available on web site: www.48i.com/nadtc/action/255FF/255summary1.htm, or on front page of Gallaudet Web-site. Also access to the information is available on www.access-board.go (or Gallaudet's site under equipment accessibility).
FCC is currently discussing what is covered by 255. Access guidelines went into effect March 5, 1998. Does not apply retroactively. Software that is bundled with CPE is covered. Any wireless handsets are covered by 255 as CPE. Guidelines are unclear on how access requirements are to be enforced. Compatibility has five criteria – external access, connection point for audio, prosthetics, TTY and TTY compatibility. The definition of "readily achievable": feasibility, legal impediments, limit access for other disabilities, level of expense, practicality, resources, connection between parent and subsidiary support, potential more for more accessible product, cost recovery, timing related to life cycle. Complaint process is not clearly defined. Process requires that FCC notify the industry of a complaint within 1 day, the industry must respond with a solution in 5 days. Extensions are available. Process then moves to informal phase at some undefined point. Another defense is the good faith defense i.e. accessible user information, internal checklists, etc. Review full summary for details.

17. NEW BUSINESS/NEXT STEPS

Look at existing TIA standard TIA/EIA 688 for connection to wireless phones. If it does not work for this group then TR30.2 will take on the standardization process.

18. NEXT MEETING

NEXT TTY Forum on: July 21-22

19. ADJOURNMENT

Meeting adjourned.

ATTENDANCE

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APPENDIX A

AGREEMENTS REACHED AT TTY FORUM - 5

- Carriers who can offer TTY users at least one digital phone model at a reasonable price by October 1, 1998 would be considered in compliance of the E9-1-1/TTY compatibility requirements.
- The FCC can use the information contained in the notification letter in any way they feel would expedite getting the information to the consumer. Consensus was achieved on this recommendation.
- David Baquis will provide the TTY Forum- 6 with a written contribution of clarification for the group regarding voice-through, as well as a contribution regarding PSAPs ability to receive calls via voice-through.
- Have a separate luncheon speaker to clarify the issue of voice -through. Invite Department of Justice to next meeting to discuss the access issues. Claude Stout will provide speaker from DOJ.
- Review Consumer Requirements Document. All written comments should be forwarded through the list server to Judy Harkins and Lynsie Hall to be shared with everyone. Deadline for comments is COB June 4, 1998.
- Create a study group to be accountable for the completion of the benchmarking and validation of TTY over digital.
  Study Group:
  Judy Harkins, leader
  John Melcher
  David Baquis
  Josh Lober
  Ron Schultz
  Norman Williams
  Deliverable for next TTY Forum: Benchmark and Validation Test
- Add the Test Completion Matrix filled out by Wesley Howe as an Appendix to the next report.
- All test results that are submitted by June 16th will be included in the Quarterly Status Report.
- The throughput test should go out to the wireless and wireline carriers. Letter will go out to all members of CTIA and PCIA and members of the Forum. Wesley Howe will be added as the point of contact for all technical questions. State in the letter that this throughput test is a starting point and benchmark not the only test possible.
- *Agreements Reached* section will be reviewed and cleaned up at the next forum.

AGREEMENTS REACHED AT TTY FORUM - 4

- Objective test (Throughput Test) approved and to be sent to manufacturers and carriers with a matrix to record testing completion dates and documentation.
- TTY Forum Test Completion Matrix approved.
- Consensus reached that Testing Matrix should go to every manufacturer listed at CTIA as well as Wireless and Wireline Carriers. CTIA/PCIA will escalate/elevate TTY Forum efforts to reach wireless equipment manufacturers and inform of urgency and criticality of rapid response to the Testing Matrix via a letter from the TTY Forum and CTIA/PCIA. The group recognizes that participation is voluntary. Copies of letter and matrix responses will be sent to the FCC.
- RFI will be put on issues list to explore possibility of interference between phone and TTY device.
- Consensus to put TTY Forum's current research opinion on output voltages (coupling information) into a formal document and present to manufacturers for feedback. Give 30 days for feedback.
- Subjective test (End User Test) to be finalized by committee. Testing will be handled through Gallaudet with assistance from Wireless manufacturers and TTY manufacturers. Will replicate authentic 9-1-1 calls with a deaf/hearing impaired caller and a trained calltaker.
- CTIA will produce a list of Analog Phones that are compatible with TTY devices to be included in notification efforts and on web sites due as a Contribution at the next TTY Forum.
- Gallaudet University and Consumer groups will draft a Consumer Requirements Document due as a Contribution at the next TTY Forum.
- CTIA/PCIA will send letter to wireless equipment manufacturers requesting that they support Gallaudet University in their testing efforts by sending equipment.
- Standards Requirements Documents (SRD) due for V.18 and the 2.5 mm jack as Contributions at next TTY Forum.

AGREEMENTS REACHED AT TTY FORUM - 3

- 6 sponsored spots for identified consumer groups, relinquished if member misses 2 consecutive meetings.
- Accept modified "readability test" to be used by phone manufacturers to benchmark TTY over digital capabilities, to determine success rate for transport. (See Contribution TTY/98.02.11.06) Two tests: Manufacturers Readability Test, End User Test
- Error rate is defined as "character" not "bit" for the purpose of this forum. (Shift error rate of ratio 1/8 (i.e. 1 shift error causes up to eight text errors and will be counted as such) to be determined)
- Develop User Requirements Document. The outcome of Working Group #2. Represents the effort to provide for future advancements in technology by looking at solutions beyond 45.45 baud, Baudot.
- 'Define process to update Notification Document: refer updated

5TTYdraft.doc   19

information to CTIA to be distributed to T-CAT.

AGREEMENTS REACHED AT TTY FORUM - 2

- Combine Working Group #1 and Working Group #3. Develop new set of deliverables based on the October 1, 1998 deadline.
    - Short term solution: solve for backward compatibility.
    - Develop Standard Test to measure error rate of TTY over digital.

AGREEMENTS REACHED AT TTY FORUM - 1

- "Solve for 45.45 Baudot, not to preclude looking for other solutions."
- Look for long term and near term solutions.
    - <u>Near term</u> - send through vocoder
    - <u>Long term</u> - circumvent vocoder, enhance quality and connectivity
- Provide for the analog function of wireless phones.
- The only body that can change the agreements reached is this body. All agreements remain intact until/unless action is taken in this forum.

APPENDIX B

Recommended Text

ATTENTION TTY USERS

Background

A TTY (also known as a TDD or Text Telephone) is a telecommunications device that allows people who are deaf, hard of hearing, or have speech or language disabilities to communicate by telephone. A TTY has a keyboard used to type a conversation, which then is transmitted as tones over a wired telephone line. The tones are translated to text that appears on a person's TTY screen.

911 and TTY Access Through Wireless Services

Federal law requires the telecommunications industry to provide a way for TTYs to communicate through **wireless systems** to make 911 calls. There are two types of wireless phones – analog and digital.

- Analog – It is possible today to use some analog wireless phones reliably to call 911 with a TTY.

- Digital – It is not possible today to use a digital wireless phone reliably to call 911 with a TTY.

Research is being done to improve the ability of digital phones to work reliably with TTYs. The industry is working to resolve this matter by October 1998.

[Optional: For more information, contact . . .]

DATE OF PUBLICATION:

APPENDIX C

TTY Forum Testing Completion Matrix

Enter completion date and document reference number for each column

Company	Technology (key specs)	Coupling	TTY Forum Throughput Test (Lab Test)	End User Test (Field Test) Provide Equip for Test
EXAMPLE: *Bell Atlantic Mobile*	*CDMA, 800MHZ*	*preliminary 3/20*	*preliminary 3/30*	*10/22/97*
Bell Atlantic Mobile	*Analog, 800MHZ*	*preliminary 3/20*	*preliminary 3/30*	*10/22/97*